SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive Butler-Volmer equation for multi-step electron transfer reactions and explain the kinetics of electrode reactions.

17. Compare and comment the dia, para, ferro, antiferro and ferrimagnetisms.

18. Give an account on rotational spectra of polyatomic molecules of

    (a) Spherical Tops

    (b) Symmetric Tops and

    (c) Asymmetric Tops

19. Describe the NMR of AX and AMX type molecules with suitable examples.

20. Describe the Fermi-Dirac statistics.

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APRIL/MAY 2025

GCH33/DCH33 — PHYSICAL CHEMISTRY III

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Whether hydrogen evolution takes place at anode or cathode? — Justify your answer.

2. Relate the different steps in hydrogen evolution reaction.

3. Calculate the magnetic moment of Cr^{3+}.

4. Point out the importance of line defects.

5. Rigid rotor approximation is good to study molecular rotations of a diatomic molecule — Comment on it.

6. Comment the similarity/difference between overtone and Fermi-resonance.

7. Mention the calibration peaks in ^1H NMR.

8. Give the chemical shift range of

(a) $R_2C = C(R)CH_3$;

(b) $R_2C = C(R)H$.

9. Differentiate Maxwell-Boltzmann statistics from and Bose-Einstein statistics.

10. Define the canonical partition function.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Discuss the symmetry factors, transfer coefficient and their significance.

Or

(b) Write a short note on the principle and applications of electrodeposition.

12. (a) Explain the principle, theory and applications of Hall effect.

Or

(b) Compare and comment the birefringence and interference properties of a material.

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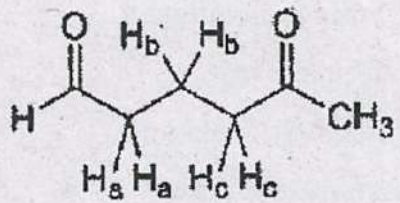
13. (a) Discuss the influence of solvent in electronic spectroscopy.

Or

(b) Explain the Raman and IR active modes of CO_2.

14. (a) Draw a splitting diagram for the following molecule and determine the relative integration values of each sub peaks. (Assume Jab ≈ Jac)



Or

(b) Explain the splitting of spectral line in the presence of magnetic field.

15. (a) Discuss the concepts of permutations and combinations and explain them with examples.

Or

(b) Explain the applications of Maxwell-Boltzmann distribution law.